

THE CLAIMS

What is claimed is:

1. A wafer susceptor for use in a substrate processing  
5 system, comprising:

at least one recess formed therein, with each recess  
is arranged and configured to hold at least one  
substrate therein, wherein a combination of said wafer  
holder and said at least one substrate forms a  
10 composite substrate having uniform processing  
characteristics.

2. The wafer susceptor of Claim 1, wherein said uniform  
processing characteristics of said composite substrate  
are achieved by matching physical properties of said  
15 wafer susceptor and said substrates.

3. The wafer susceptor of Claim 3, wherein said physical  
properties comprise at least one property selected  
from the group consisting of:

Thermal coefficient of expansion;

20 Reflectivity;

Thermal mass;  
Thermal conductivity;  
Electrical resistivity;  
Dielectric constant;  
5 Dielectric loss;  
Density;  
Hardness; and  
Emissivity.

10 The wafer susceptor, wherein said wafer susceptor is used  
in a semiconductor substrate processing system,  
comprising a reactor having at least one single  
substrate deposition chambers, and further comprising  
an automated substrate transport assembly including a  
wand array comprising a plurality of wands constructed  
15 and arranged to simultaneously transport a  
corresponding plurality of substrates into and out of  
the deposition chamber.

4. The system of claim 5, further comprising an automated  
substrate transport assembly arranged for serially  
20 transporting single ones of a plurality of substrates  
into and out of the deposition chamber.

5. The system of claim 5, further comprising an automated substrate transport assembly.

6. The system of claim 7, further comprising a substrate cassette for storage and bulk transport of plural arrays of substrates, and position able in substrate pickup and substrate delivery relationship to the automated substrate transport assembly.

7. The system of claim 8, further comprising an automated substrate transport assembly including a wand array comprising a plurality of wands constructed and arranged to simultaneously transport a corresponding plurality of substrates into and out of the deposition chamber, wherein the automated substrate transport assembly and substrate cassette are constructed and arranged so that when the automated substrate transport assembly is translated into a pickup position relative to the substrate cassette, said plurality of wands engage and extract a plurality of substrates from the substrate cassette, with each wand engaging and extracting a substrate from a different one of said plural arrays of substrates, and so that when the automated substrate transport assembly is translated into a deposit position relative to the

substrate cassette, said plurality of wands release  
and deposit a plurality of substrates on the substrate  
cassette, with each wand releasing and depositing a  
substrate into a different one of said plural arrays  
of substrates.

8. The system of claim 5, further comprising an automated  
substrate transport assembly including a double-sided  
wand array comprising a plurality of wands constructed  
and arranged to simultaneously transport a  
corresponding plurality of substrates into and out of  
the deposition chamber.

9. The system of claim 5, further comprising a loadlock  
chamber, and a windless automated substrate transport  
assembly including a multiparted cassette, and a  
transport arm arranged to selectively engage said  
multiparted cassette and disengage from said  
multiparted cassette in the loadlock chamber.

10. The system of claim 5, further comprising an etch  
chamber for regeneration of a wafer, at least two  
wafer holders and an automated substrate transport  
assembly arranged to introduce one of said at least  
two wafer holders into the reactor while another of

said at least two wafer holders is in said etch  
chamber, and to thereafter extract wafer holders from  
the reactor and etch chamber, followed by introduction  
of the wafer holder from the etch chamber into the  
5 reactor, and introduction of the wafer holder from the  
reactor into the etch chamber.

11. The system of claim 5, wherein the wafer holder  
has two recesses therein.

12. The system of claim 5, wherein the wafer holder  
10 has four recesses therein.

13. The system of claim 5, wherein the wafer holder  
has a diameter in the range of from about 200mm to  
about 350mm.

14. The system of claim 5, wherein the wafer holder  
15 has a diameter in the range of from about 200mm to  
about 300mm.

15. The system of claim 5, wherein each of the wafer  
holder recesses has a diameter in the range of from  
about 100mm to about 150mm.

20 16. The system of claim 5, wherein each of the wafer

holder recesses has a diameter in the range of from  
about 100mm to about 125mm.

17. The system of claim 5, further comprising a  
substrate cassette including slot members for  
5 positioning substrates in plural arrays, and wherein  
successive arrays are in side-by-side relationship to  
one another.

18. The system of claim 19, wherein the substrate  
cassette is constructed and arranged for holding two  
10 arrays of substrates, wherein all substrates are  
planar and each respective substrate in a first array  
is generally coplanar with a corresponding respective  
substrate in a second array.

19. The system of claim 20, wherein the first and  
15 second arrays are parallel to one another.

20. The system of claim 5, further comprising an  
automated substrate transport assembly and a substrate  
cassette, wherein the substrate holder, automated  
substrate transport assembly, and substrate cassette  
20 are constructed and arranged to simultaneously process  
two substrates.

21. The system of claim 5, wherein the reactor  
comprises a single wafer deposition chamber sized for  
processing single substrates having a 200mm diameter.

22. The system of claim 5, wherein the plurality of  
5 recesses formed in the wafer holder are arranged and  
configured to hold substrates having a 100mm diameter.

23. The system of claim 5, wherein each of the  
recesses formed in the wafer holder is circular.

24. The system of claim 5, further comprising a  
10 processor for programmably operating the automated  
substrate transport assembly according to a cycle time  
program.

25. A method of increasing the throughput of a single  
substrate deposition chamber, said method comprising:  
15 positioning in said single substrate deposition  
chamber a wafer susceptor having at least one recess  
formed therein, with each recess being arranged and  
configured to hold at least one substrate therein,  
wherein a combination of said wafer susceptor and at  
20 least one substrate form a composite substrate having  
uniform processing characteristics.

26. The method of Claim 25, wherein said uniform processing characteristics of said composite substrate are achieved by matching physical properties of said wafer susceptor and said substrates.

5 27. The method of Claim 26, wherein said physical properties comprise at least one property selected from the group consisting:

thermal coefficient of expansion;

reflectivity;

10 thermal mass;

thermal conductivity;

electrical resistivity;

dielectric constant;

dielectric loss;

15 density;

hardness; and

emissivity.

28. The method of claim 27, further comprising providing an automated substrate transport assembly including a wand array comprising a plurality of wands

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constructed and arranged to simultaneously transport a corresponding plurality of substrates into and out of the deposition chamber.

5 29. The method of claim 27, further comprising providing an automated substrate transport assembly arranged for serially transporting single ones of a plurality of substrates into and out of said deposition chamber.

30. The method of claim 27, further comprising providing an automated substrate transport assembly.

10 31. The method of claim 30, further comprising providing a substrate cassette for storage and bulk transport of plural arrays of substrates, wherein the cassette is position able in substrate pickup and substrate delivery relationship to the automated substrate  
15 transport assembly.

32. The method of claim 31, further comprising providing an automated substrate transport assembly including a wand array comprising a plurality of wands constructed and arranged to simultaneously transport a  
20 corresponding plurality of substrates into and out of the deposition chamber, wherein the substrate cassette

contains plural arrays of substrates, and positioning  
the substrate cassette in substrate pickup and  
substrate delivery relationship to the automated  
substrate transport assembly; and operating the  
5 semiconductor processing system by:

translating the automated substrate transport  
assembly into a pickup position relative to the  
substrate cassette, so that the plurality of wands  
engage and extract a plurality of substrates from the  
10 substrate cassette, with each wand engaging and  
extracting a substrate from a different one of the  
plural arrays of substrates;

translating the automated substrate transport  
assembly carrying the engaged and extracted substrates  
15 to the deposition chamber and releasing the substrates  
into respective recesses in the wafer holder;

depositing thin film material on the substrates  
in the deposition chamber, to yield coated substrates;

translating the automated substrate transport  
20 assembly into the deposition chamber after the  
depositing step is completed and extracting the coated

substrates from the respective recesses in the wafer  
susceptor;

translating the automated substrate transport  
assembly carrying the extracted coated substrates into  
5 a deposit position relative to said substrate cassette  
or a second substrate cassette, and releasing the  
coated substrates to said substrate cassette or a  
second substrate cassette;

whereby the throughput of the semiconductor  
10 processing system is increased relative to serial  
transport and processing of individual substrates.

33.The method of claim 27, comprising using a double-  
sided wand assembly comprising a plurality of wands  
and arranged to simultaneously transport a  
15 corresponding plurality of substrates into and out of  
the deposition chamber.

34.The method of claim 27, comprising sequentially using  
multiple wafer holders including positioning one of  
the multiple wafer holders in the deposition chamber  
20 for processing of wafers thereon, and concurrently  
regenerating another of said wafer holders after it

has been in the deposition chamber during processing  
of wafers thereon.

35.The method of claim 34, wherein said regenerating  
comprises etch processing of said another of said  
5 wafer holders.

36.The method of claim 27, wherein the wafer holder has  
two recesses therein.

37.The method of claim 27, wherein the wafer holder has  
four recesses therein.

10 38.The method of claim 27, wherein the wafer holder has a  
diameter in the range of from about 200mm to about  
350mm.

15 39.The method of claim 27, wherein the wafer holder has a  
diameter in the range of from about 200mm to about  
300mm.

40.The method of claim 27, wherein each of the wafer  
holder recesses has a diameter in the range of from  
about 100mm to about 150mm.

41.The method of claim 27,, wherein each of the wafer

holder recesses has a diameter in the range of from  
about 100mm to about 125mm.

42.The method of claim 27, further comprising providing a  
substrate cassette including slot members for  
5 positioning substrates in plural arrays, and wherein  
successive arrays are in side-by-side relationship to  
one another.

43.The method of claim 27, further comprising providing a  
substrate cassette that is constructed and arranged  
10 for holding two arrays of substrates, wherein all  
substrates are planar and each respective substrate in  
a first array is generally coplanar with a  
corresponding respective substrate in a second array.

44.The method of claim 43, wherein the first and second  
15 arrays are parallel to one another.

45.The method of claim 27, further comprising providing  
an automated substrate transport assembly and a  
substrate cassette, wherein the substrate holder,  
automated substrate transport assembly, and substrate  
20 cassette are constructed and arranged to  
simultaneously process two substrates.

46.The method of claim 27, wherein the reactor comprises  
a single wafer deposition chamber sized for processing  
single substrates having a 200mm diameter.

47.The method of claim 27, wherein the plurality of  
recesses formed in the wafer holder are arranged and  
configured to hold substrates having a 100mm diameter.

48.The method of claim 27, wherein each of the recesses  
formed in the wafer holder is circular.

49.The method of claim 27, further comprising providing  
an automated substrate transport assembly for  
transporting substrates into and out of the deposition  
chamber, and programmably operating the automated  
substrate transport assembly according to a cycle time  
program.